Relationship Between Nonverbal Measure of Intelligence and Achievement Performance in Rural, Latinx Youth

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Introduction

The weight of psychological assessment results in determining interventions for youth dictates the importance of minimizing cultural bias. Achievement tests are an area where future research is needed in order to understand diversity factors (Reynolds, Altman & Allen, 2021). When foreign-born children are given the Woodcock-Johnson Tests of Achievement (WJ-ACH) in English, it has been shown that they score between .71 and 1.5 standard deviations lower when randomly assigned the test in English (Akresh & Akresh, 2011). The Wechsler Nonverbal Scale of Ability (WNV), however, has been shown to be effective in measuring cognitive ability in culturally diverse groups due to minimization of language demands (Naglieri & Otero, 2012). Previous research found that another nonverbal ability measure, the UNIT (Universal Nonverbal Intelligence Test), shows a moderate correlation with the WJ-ACH for math scores and weak correlations for the reading and writing scores (Bell, McConnell, Lassiter, & Matthews, 2013).

The current study examines the relationship between a the WNV, a nonverbal measure of general intelligence, and academic achievement, specifically within a rural Latinx population.

Methods

Participants:

- Participants (n=15) were Latinx youth, ages 8 to 17 years old
  - 9 males, 6 females
- Each participant was administered the Wechsler Nonverbal Scale of Ability (WNV) and the Woodcock-Johnson Tests of Achievement-IV (WJ-IV ACH).

Measures:

- The WNV provides nonverbal measure of intellectual ability, particularly relevant for diverse populations.
  - The Full Scale for this age group is comprised of four subtests: 1) Matrices, 2) Coding, 3) Spatial Span, and 4) Picture Arrangement.
- The WJ-IV ACH measures academic skills and provides a *Broad Achievement* index and cluster scores across academic domains: reading, mathematics, and writing.

Procedure:

- Correlations were run to analyze the relationships between youth's cognitive abilities on the WNV, including Full Scale and the four subtests, and performance on the WJ-IV ACH.
- Within the WJ-IV ACH comparison scores included the *Broad Achievement* score and academic cluster domain scores.

Results

A moderate correlation was found between the WNV Full Scale and the WJ-IV ACH Broad Achievement (r = .44, p= .150, CI [-.17, .81]). WNV Matrices and Picture Arrangement scores were moderately related to Broad Achievement (r = .39, p= .21, CI [-.24, .79]; r = .39, p= .20, CI [-.23, .79]). Matrices scores were strongly correlated to reading fluency, and moderately correlated with broad reading and math problem solving. Coding was moderately associated with math calculation (r = .48). Spatial Span skills were strongly correlated with math problem solving (r=.53) and moderately linked to math calculation (r = .48). Picture Arrangement scores were moderately correlated with academic cluster scores of broad reading, reading comprehension, math problem solving, and written expression (r = .37; r = .31; r = .33; r = .30).

Table 1: Pearson Correlation Between WNV and WJ-ACH Domains

Domain	WNV Full Scale	WNV Matrices	WNV Picture Arrangement	WNV Spatial Span	WNV Coding
WJ-ACH Broad Achievement	.44	.39	.39	.28	-.09
WJ-ACH Broad Reading	.29	.39	.37	.15	-.18
WJ-ACH Reading Fluency	.28	.60	.25	.15	-.05
WJ-ACH Reading Comprehension	.21	.03	.31	.23	-.13
WJ-ACH Math Problem Solving	.50	.34	.33	.53	-.09
WJ-ACH Math Calculation	.48	.15	.30	.30	.48
WJ-ACH Written Expression	.41	.29	.30	.24	.14

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Conclusion

Discussion:

Current results suggest that there is a language component inherent to the Woodcock-Johnson Tests of Achievement-IV (WJ-IV ACH) that may underestimate the reading abilities of Latinx children. However, Math Problem Solving is moderately correlated with Wechsler Nonverbal Scale of Ability (WNV) Full Scale intelligence, possibly due to higher loading on fluid reasoning within this domain as compared to the reading domains. This is consistent with literature from previous other nonverbal measures compared to the WJ-IV ACH, where reading had a weak correlation with nonverbal measures and mathematical domains had more moderate correlations. Surprisingly, there is a moderate correlation between WNV scores and writing domains which is a stronger correlation than expected from previous research surrounding writing domains on the Woodcock Johnson Tests of Achievement and nonverbal measures of intelligence. **Overall, results suggest associations between Latinx youth's nonverbal intellectual abilities and their performance across the WJ-IV ACH, most especially within academic math domains.**

Limitations:

- Limitations to this research included the small sample size, as it is hard to generalize results with a small number of participants.
- Another significant limitation to this study is the region in which data was collected, where the entirety of the sample size was from one rural school district within a predominantly European-American area.

Future Directions:

- As results were only collected in the Pacific Northwest, future studies could look at Latinx youth across the country to see if similar result are found. This would also aide in the generalizability of this study.
- Larger numbers of participants, as well as a sample that includes youth with languages of origin apart from Spanish, will allow more sophisticated analyses of the relationship between cognitive abilities and academic achievement.
- Future research on diversity-informed methods of assessing academic achievement is needed. Although there are several nonverbal tools available for evaluating intelligence in culturally and linguistically diverse youth, current protocols for academic achievement, including both individualized and standardized methods remain highly dependent on English language skills.